

facts of observation, and the introduction of redundant constants to diminish the residual errors formed from observations extending over only limited intervals of time, rather than from existing errors of observation. But such errors are undoubtedly quite sensible, and every step which tends to diminish them is one in the right direction, and should be most carefully utilised.

Note on the Distribution of the Stars generally used for the Determination of Clock-Error. By E. J. Stone, M.A., F.R.S., Radcliffe Observer.

The authorities at Greenwich for a great many years have annually published and distributed a list of the Mean Right Ascensions of some 215 stars, brought up from the latest *Greenwich Catalogue*, and corrected, when necessary, from recent observations. This list has been found exceedingly useful by many astronomers, more particularly for the determination of the errors of their clocks. The apparent places of most of the Greenwich stars are included in the current *Nautical Almanacs*; and I understand that the whole of them will be included in future volumes. But the *distribution* of the clock-stars in this list about the equator is not very satisfactory, and I have thought that this might easily be improved; and, to test opinion on this point, the following list has been prepared. I have not ventured to cut out any of the stars which are now on the Greenwich list; but if the number of stars required to fill up the gaps should be thought to render the total number of stars inconveniently large for that constant re-observation which is desirable, there are some of the stars now in the list which might be cut out without any serious practical loss. The Right Ascensions given for the additional stars are close approximations to the true values; and although they are not at present as accurate as the Right Ascensions of most of the other stars, the errors are so small that, if adopted for clock-stars, their places would be rapidly improved without leading to any practical inconvenience.

Two diagrams showing the general distribution of the stars are appended.

Greenwich List of Clock-Stars, 1894.

Name of Star.	Magnitude.	Mean R.A. 1894.			Approx. N.P.D.
		h	m	s	
α Andromedæ	2	0	2	54.44	61° 30'
γ Pegasi	3-2	0	7	46.58	75 24
ϵ Ceti	3-4	0	14	1.56	99 25
44 Piscium	6	0	19	58.08	88 39
12 Ceti	6	0	24	37.70	94 33
ϵ Andromedæ	4	0	32	57.17	61 16
β Ceti	2	0	38	16.11	108 34
δ Piscium	5-4	0	43	10.89	83 0
20 Ceti	5	0	47	35.37	91 43
μ Andromedæ	4	0	50	52.02	52 5
ϵ Piscium	4	0	57	26.43	82 41
β Andromedæ	2-3	1	3	47.74	54 56
ζ^1 Piscium	5	1	8	11.48	82 59
θ Ceti	3	1	18	43.44	98 44
η Piscium	4-3	1	25	48.58	75 12
ν Piscium	4-5	1	35	54.81	85 3
\circ Piscium	4	1	39	47.66	81 23
β Arietis	3-2	1	48	46.96	69 43
α Arietis	2	2	1	11.79	67 2
ξ^1 Ceti	5	2	7	22.79	81 39
67 Ceti	6-5	2	11	41.72	96 55
ξ^2 Ceti	4	2	22	31.30	82 1
ν Ceti	5-4	2	30	18.61	84 52
δ Ceti	4-3	2	34	2.89	90 8
γ Ceti	3	2	37	48.40	87 13
σ Arietis	6-5	2	45	38.32	75 21
ϵ Arietis	4-5	2	53	8.95	69 5
α Ceti	2-3	2	56	44.24	86 20
δ Arietis	4-5	3	5	33.95	70 40
τ^1 Arietis	5	3	15	6.34	69 14
\circ Tauri	4-3	3	19	6.44	81 21
f Tauri	4	3	25	1.16	77 26
ϵ Eridani	4-3	3	27	56.11	99 49
11 Tauri	6	3	34	26.36	65 1
δ Eridani	3-4	3	38	10.15	100 7
η Tauri	3	3	41	10.93	66 13

Name of Star.	Magnitude.	Mean R.A. 1894.			Approx. N.P.D.
		h	m	s	
γ^1 Eridani	3	3	53	4.96	103° 49'
A^1 Tauri	5-4	3	58	25.64	68 12
ω^1 Tauri	5-6	4	2	59.35	70 40
ϕ^1 Eridani	4-5	4	6	41.41	97 7
γ Tauri	4	4	13	45.56	74 38
ϵ Tauri	4-3	4	22	25.55	71 3
Aldebaran	1	4	29	50.22	73 42
τ Tauri	4-5	4	35	52.90	67 15
μ Eridani	4-5	4	40	12.03	93 27
ι Aurigæ	3	4	50	5.37	57 0
ϵ Leporis	3-2	5	0	58.39	112 31
Rigel	1	5	9	26.58	98 19
β Tauri	2	5	19	35.43	61 29
δ Orionis	3-2	5	26	35.38	90 23
α Leporis	3-2	5	28	3.26	107 54
ϵ Orionis	2-1	5	30	50.05	91 16
α Columbæ	2	5	35	48.68	124 8
κ Orionis	2-3	5	42	43.71	99 42
α Orionis	1-2	5	49	25.95	82 37
\mathbf{I} Geminorum	5-4	5	57	40.56	66 44
ν Orionis	4-5	6	1	31.13	75 13
η Geminorum	3-4	6	8	28.72	67 28
μ Geminorum	3	6	16	32.82	67 26
β Canis Majoris	2	6	18	1.85	107 54
ν Geminorum	5	6	22	40.13	69 43
γ Geminorum	2-3	6	31	35.26	73 31
ξ Geminorum	3-4	6	39	20.36	76 59
θ Canis Majoris	4-5	6	49	15.85	101 54
ϵ Canis Majoris	2	6	54	27.54	118 50
ζ Geminorum	4	6	57	49.28	69 16
γ Canis Majoris	4-5	6	58	57.70	105 29
$\mathbf{51}$ Geminorum	6-5	7	7	17.04	73 40
δ Geminorum	3-4	7	13	47.52	67 49
β Canis Minoris	3	7	21	24.11	81 30
Castor	2	7	27	50.20	57 53
Procyon	1	7	33	45.27	84 30
Pollux	1-2	7	38	49.79	61 43
ξ Argûs	3-2	7	44	50.12	114 36

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Name of Star.	Magnitude.	Mean R.A. 1894.			Approx. N.P.D.
		h	m	s	
6 Cancri	5	7	57	0.47	61° 54'
ρ Argûs	3-2	8	3	1.73	114 0
β Cancri	4-3	8	10	45.97	80 29
d ¹ Cancri	6-5	8	17	17.64	71 20
η Cancri	6-5	8	26	34.74	69 12
γ Cancri	4-5	8	37	9.11	68 9
ε Hydræ	4-3	8	41	9.69	83 12
α Cancri	4	8	52	41.40	77 44
κ Cancri	6-5	9	2	0.36	78 54
83 Cancri	6	9	13	3.90	71 51
α Hydræ	2	9	22	22.67	98 12
ξ Leonis	5	9	26	13.91	78 14
ο Leonis	4-3	9	35	29.57	79 38
ε Leonis	3	9	39	50.07	65 44
μ Leonis	4	9	46	44.10	63 30
π Leonis	5	9	54	36.69	81 27
Regulus	1-2	10	2	43.60	77 31
γ ¹ Leonis	3	10	14	7.71	69 37
μ Hydræ	4	10	20	57.77	106 18
ρ Leonis	4	10	27	13.78	80 9
34 Sextantis	6-7	10	37	9.05	85 52
l Leonis	5	10	43	41.12	78 54
d Leonis	5	10	55	5.15	85 49
χ Leonis	5	10	59	32.92	82 5
δ Leonis	2-3	11	8	28.28	68 54
δ Crateris	4-3	11	14	2.40	104 12
τ Leonis	5-4	11	22	29.13	86 34
ν Leonis	4-5	11	31	31.23	90 14
β Leonis	2	11	43	39.16	74 50
β Virginis	4-3	11	45	10.39	87 38
π Virginis	4-5	11	55	26.44	82 48
ο Virginis	4	11	59	48.55	80 41
ε Corvi	4-3	12	4	40.32	112 2
η Virginis	4-3	12	14	28.90	90 5
δ ² Corvi	3-4	12	24	22.72	105 56
β Corvi	3-2	12	28	49.07	112 49
ρ Virginis	5-4	12	36	31.13	79 11
35 Virginis	6-7	12	42	27.53	85 51

Name of Star.	Magnitude.	Mean R.A. 1894.			Approx. N.P.D.
		h	m	s	
31 Comæ	5-6	12	46	32.12	61° 53'
δ Virginis	3-4	12	50	15.80	86 2
ε Virginis	2-3	12	56	54.00	78 28
θ Virginis	4-5	13	4	27.62	94 58
Spica	2-1	13	19	36.46	100 36
ζ Virginis	4-3	13	29	17.44	90 3
m Virginis	6-5	13	36	2.82	98 10
τ Boötis	5-4	13	42	13.46	72 1
η Boötis	3	13	49	38.23	71 4
τ Virginis	4-5	13	56	15.05	87 57
94 Virginis	7-6	14	0	40.90	98 23
κ Virginis	4-5	14	7	14.39	99 47
Arcturus	1	14	10	49.56	70 16
f Boötis	5	14	21	31.51	70 18
ρ Boötis	3-4	14	27	15.68	59 10
ε ² Boötis	3	14	40	21.43	62 29
α Libræ	3	14	45	0.79	105 36
ξ ² Libræ	5-6	14	51	0.92	100 59
ψ Boötis	4-5	14	59	54.21	62 38
ι ¹ Libræ	5	15	6	10.66	109 23
β Libræ	3	15	11	18.08	98 59
ο ² Libræ	7-6	15	17	6.96	104 45
ζ ¹ Libræ	6-5	15	22	16.63	106 21
α Coronæ	2	15	30	11.95	62 56
α Serpentis	3-2	15	39	2.77	83 14
ε Serpentis	4-3	15	45	31.87	85 12
γ Serpentis	4-3	15	51	33.39	74 0
β ¹ Scorpæ	3-2	15	59	16.26	109 31
δ Ophiuchi	3-2	16	8	47.34	93 25
γ Herculis	3	16	17	14.58	70 36
Antares	1-2	16	22	54.40	116 12
λ Ophiuchi	3-4	16	25	33.97	87 47
ζ Ophiuchi	3-2	16	31	19.25	100 21
ζ Herculis	3-2	16	37	17.37	58 12
κ Ophiuchi	3-2	16	52	39.00	80 28
ε Herculis	3-4	16	56	13.98	58 55
η Ophiuchi	2-3	17	4	17.84	105 36
α ¹ Herculis	3	17	9	48.80	75 29

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Distribution of Clock-Stars.

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Name of Star.	Magnitude.	Mean R.A.	Approx.
		1894. h m s	N.P.D. ° '
θ Ophiuchi	4-3	17 15 29.89	114 54
σ Ophiuchi	5-4	17 21 15.26	85 46
α Ophiuchi	2-3	17 30 0.79	77 22
β Ophiuchi	3-2	17 38 14.11	85 23
μ Herculis	3-4	17 42 18.55	62 13
89 Herculis	6-5	17 51 8.58	63 56
72 Ophiuchi	3-4	18 2 19.42	80 27
μ Sagittarii	5-4	18 7 25.40	111 5
η Serpentis	3-4	18 15 49.42	92 56
λ Sagittarii	3	18 21 25.67	115 29
α Lyræ	1	18 33 20.94	51 19
2 Aquilæ	5-4	18 36 28.13	99 9
β ¹ Lyræ	4-3	18 46 9.96	56 46
ε Aquilæ	4	18 54 48.65	75 5
ζ Aquilæ	3	19 0 32.25	76 18
ψ Sagittarii	5-6	19 9 2.42	115 26
ω Aquilæ	5	19 12 50.42	78 36
δ Aquilæ	3-4	19 20 9.20	87 6
α Vulpeculæ	5-4	19 24 17.65	65 33
μ Aquilæ	5-4	19 28 54.64	82 51
h ² Sagittarii	5-4	19 30 15.40	115 7
e ¹ Sagittarii	6-5	19 34 38.99	106 32
γ Aquilæ	3-2	19 41 13.17	79 39
α Aquilæ	1	19 45 36.65	81 25
β Aquilæ	4	19 50 6.33	83 51
c Sagittarii	5-4	19 56 8.37	118 0
θ Aquilæ	3-4	20 5 50.09	91 8
α ² Capricorni	4-3	20 12 10.39	102 52
β Capricorni	3-4	20 15 3.31	105 7
ρ Capricorni	5	20 22 48.87	108 10
ε Delphini	4	20 28 8.89	79 3
α Delphini	4	20 34 42.83	74 28
ε Aquarii	4-3	20 41 56.25	99 53
μ Aquarii	5-4	20 46 56.16	99 23
32 Vulpeculæ	5	20 50 2.51	62 21
θ Capricorni	4-5	20 59 59.31	107 39
ζ Cygni	3-4	21 8 25.47	60 12
α Equulei	4	21 10 31.48	85 11

N N

Name of Star.	Magnitude.	Mean R.A. 1894.			Approx. N.P.D.
		h	m	s	
ι Capricorni	4-5	21	16	20.65	107 17
β Aquarii	3	21	25	58.70	96 2
ξ Aquarii	5-4	21	32	6.52	98 20
ϵ Pegasi	2-3	21	38	58.73	80 37
δ Capricorni	3	21	41	11.38	106 36
16 Pegasi	5	21	48	14.27	64 34
α Aquarii	3-4	22	0	20.32	90 50
ι Pegasi	4	22	2	4.53	65 10
θ Aquarii	4-5	22	11	14.38	98 19
γ Aquarii	4	22	16	10.83	91 55
σ Aquarii	5-4	22	25	2.24	101 13
η Aquarii	4-5	22	29	54.50	90 40
ζ Pegasi	4-3	22	36	10.47	79 43
μ Pegasi	4-3	22	44	53.17	65 57
λ Aquarii	4-3	22	47	5.03	98 9
Fomalhaut	1-2	22	51	47.57	120 11
α Pegasi	3-2	22	59	28.79	75 22
γ Piscium	4-3	23	11	40.16	87 18
κ Piscium	5	23	21	29.87	89 19
ι Piscium	4-5	23	34	29.81	84 57
δ Sculptoris	5-4	23	43	24.31	118 43
ω Piscium	4-5	23	53	52.02	83 43
2 Ceti	5-4	23	58	18.57	107 56

Proposed Additions to Clock-Star List.

Name of Star.	Magnitude.	Mean R.A. 1894.			Approx. N.P.D.
		h	m	s	
58 Piscium	6-5	0	41	29.65	78 36
ϕ^2 Ceti	6-5	0	44	49.04	101 13
η Andromedæ	5-4	0	51	32.74	67 9
Lalande 3159	5-6	1	37	21.86	94 13
τ Ceti	4-3	1	39	8.54	106 30
ν Ceti	4	1	55	0.56	111 36
α Piscium	4	1	56	33.32	87 45
π Ceti	5-4	2	39	4.57	104 18
τ^1 Eridani	5-4	2	40	9.24	109 1
η Eridani	3-4	2	51	14.89	99 19
τ^5 Eridani	4	3	29	6.24	111 59
10 Tauri	5	3	31	27.78	89 56

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Name of Star.	Magnitude.	Mean R.A. 1894.			Approx. N.P.D.
		h	m	s	
ν Tauri	4	3	57	30 ^o 97	84 18
Lalande 8205	6-5	4	16	1 ^o 49	110 54
53 Eridani	4-5	4	33	19 ^o 45	104 31
π^1 Orionis	3-4	4	44	5 ^o 04	83 13
15 Orionis	5-4	5	3	37 ^o 84	74 32
ζ Tauri	3-4	5	31	18 ^o 56	68 55
γ Leporis	4	5	40	2 ^o 61	112 29
10 Monocerotis	5-6	6	22	43 ^o 51	94 42
ξ^1 Canis Majoris	4	6	27	26 ^o 24	113 21
18 Monocerotis	5-4	6	42	20 ^o 02	87 28
22 Monocerotis	5	7	6	27 ^o 05	90 19
γ Monocerotis	5-4	7	36	10 ^o 86	99 18
g Geminorum	5	7	39	59 ^o 27	71 14
B.A.C. 2666	5-6	7	55	6 ^o 94	108 6
Bradley 1197	4	8	20	21 ^o 79	93 34
Lalande 17103	6-5	8	34	29 ^o 40	112 18
12 Hydræ	5-4	8	41	22 ^o 00	103 9
θ Hydræ	4-3	9	8	50 ^o 98	87 14
κ Hydræ	6-5	9	35	13 ^o 46	103 51
Lalande 19034	5-6	9	36	26 ^o 75	113 6
15 Sextantis	5	10	2	30 ^o 69	89 51
41 Sextantis	6	10	44	58 ^o 97	98 20
β Crateris	5-4	11	6	26 ^o 62	112 15
θ Crateris	4-5	11	31	18 ^o 24	99 13
ζ Crateris	5-6	11	39	23 ^o 37	107 45
7 Comæ	5-6	12	10	58 ^o 73	65 28
χ Virginis	5	12	33	46 ^o 45	97 25
α Comæ	4-5	13	4	49 ^o 85	71 55
γ Hydræ	3	13	13	9 ^o 39	112 37
B.A.C. 4559	6-5	13	34	21 ^o 00	78 43
89 Virginis	6-5	13	44	6 ^o 64	107 36
9 Boötis	5	13	51	43 ^o 76	61 59
ζ Boötis*	3-4	14	36	5 ^o 19	75 49
4 Libræ	6-5	14	37	5 ^o 83	114 33
109 Virginis	4-3	14	40	53 ^o 34	87 40
τ^1 Serpentis	5-6	15	20	52 ^o 31	74 12

* The star, Piazzì XIV.-145, 6-7 mag., 14^h 35^m 38^s.16, 76° 1', might be substituted for ζ Boötis, which is double.

N N 2

Name of Star.	Magnitude.	Mean R.A.	Approx. N.P.D.
		1894. h m s	
11 Serpentis	6	15 27 30.27	90 50
30 Ophiuchi	6	16 55 28.17	94 4
δ Herculis	3-4	17 10 40.64	65 2
ξ Serpentis	4	17 31 30.97	105 20
ν Ophiuchi	4-3	17 53 11.40	99 46
109 Herculis	4	18 19 10.83	68 17
4 Aquilæ	5	18 39 28.91	88 3
O. A. (S.) 18841	6-5	18 49 37.84	106 30
κ Aquilæ	5-6	19 31 11.32	97 16
δ Sagittæ	4-3	19 42 39.66	71 44
23 Vulpeculæ	5-4	20 11 22.54	62 31
71 Aquilæ	4-5	20 32 51.81	91 28
ψ Capricorni	4-5	20 39 49.06	115 39
1 Pegasi	4-5	21 17 11.03	70 39
41 Capricorni	5-6	21 35 58.51	113 44
B.A.C. 7742	6	22 6 44.18	74 29
47 Aquarii	5-6	22 15 45.39	112 8
31 Pegasi	5	22 16 17.99	78 20
α ² Aquarii	4-3	23 3 47.62	111 45
ν Pegasi	5-4	23 20 5.24	67 11
ω ¹ Aquarii	5-6	23 34 17.18	104 48
20 Piscium	6-5	23 42 29.54	93 21

Radcliffe Observatory, Oxford:
1894 June 7.

On the R—D Discordance. By Professor H. H. Turner,
M.A., B.Sc.

(*Abstract.*)

1. The following is a brief abstract of a paper by Mr. W. G. Thackeray and myself, which will shortly appear in the *Memoirs*.

2. Various researches have been undertaken by us in recent years with the view of elucidating questions connected with the R—D discordance. These have resulted in showing—

First, that the cause of the discordance can *not* be traced in one or two directions already suggested as probably the right ones.